# ON THE RISE: Earth's climate to become warmer and more volatile

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**Byline:** MARK LOWEY

## Body

Global warming, most scientists agree, is more than a lot of hot air. But is it enough to worry the average prairie dweller, who's more recently preoccupied with shovelling snow and scraping ice off the windshield?

People should recognize some facts about which there's no disagreement -- even among climate experts:

* A natural "greenhouse effect" is real; it's happening as you read this.

Greenhouse gases (nitrogen, oxygen, carbon dioxide) in the planet's atmosphere trap heat from the Sun, warming the Earth's surface and making life possible.

* Since we started burning fossil fuels and emitting more carbon dioxide, the amount of CO2 in the atmosphere has steadily increased.

CO2 concentrations are now about 360 parts per million, about a 25-per-cent jump from the 280 ppm levels in 1800.

Here's another way of looking at it: six billion tonnes of carbon (at least five billion from industrial emissions) now go into the atmosphere every year, compared with one billion tonnes in pre-industrial times.

* Most greenhouse gases remain from 50 to 200 years in the atmosphere. So reducing emissions on Earth now would bring about only a slow change in gas concentrations "upstairs."

* Most climate studies show a strong link between the concentration of greenhouse gases in Earth's atmosphere and average temperatures worldwide. The Earth is about a half-degree C warmer than it was 100 years ago.

Nearly all scientists agree that the buildup of greenhouse gases will have some effects on climate. Some experts disagree about whether these effects will be significant, and what we should or can do to prepare.

PREDICTING THE FUTURE

Climate experts spend a lot of time punching CO2 concentrations and other factors into supercomputers that spit out models, or predictions, of what the world's future climate will look like.

Gordon McBean, an assistant deputy minister of Environment Canada and chairman of the co-ordinating committee for the World Climate Program, says those models convince him that, by the end of the next century, the average surface temperature around the world will rise by one to four degrees C.

"I'm personally of the belief that we will see climate change happen," McBean told a recent Calgary symposium on the science of climate change. "We understand it well enough now that appropriate actions do make sense."

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The International Panel on Climate Change, a respected U.N.-sponsored body of more than 1,500 leading climate experts from 60 nations, reached the same conclusion last month in a comprehensive report.

One to four degrees Centigrade doesn't sound like much. But it's a huge, lightning-quick jump compared with the average global temperature for the past 2,000 years.

Higher-latitude regions, such as Canada, will warm up more than regions near the equator, McBean said. Over the next 50 years, Canada will experience dramatic warming in winters, less so in summers.

Computer models also predict a rise in sea levels, due to heat expansion and glaciers melting, of between 10 centimetres to more than a metre by the end of the next century.

More than a metre would swamp not only Bangladesh and other major river delta regions, but much of downtown Vancouver. Rising seas would displace more than 100 million people worldwide.

BUGS IN THE COMPUTER?

Not so fast, say the gadflys in the computer climate model.

The crux of the scientific disagreement is, "We don't know what the enhanced greenhouse effect is," says Richard Lindzen, professor of meteorology at the Massachusetts Institute of Technology.

Computer climate models, rife with assumptions, vary widely in their predictions and they are unable to account for longterm natural variations in the climate, Lindzen said.

Models are simplistic, he added, compared with climate which depends on many, poorly understood components -- from mechanisms by which Earth radiates heat, to the role that oceans play in modifying climate.

"When you couple atmospheric and oceanic (computer) models, they drift apart hopelessly," he said.

Latest research shows the models exaggerate by a factor of 10 or more the effect modellers are looking for, Lindzen noted.

"Lots of areas remain uncertain," acknowledges Stephen Schneider, professor of biological sciences at Stanford University and senior scientist at the National Center for Atmospheric Research in Boulder, Colorado.

The smallest scale that present computer models are able look at is typically the size of Colorado, he said. And that's insufficient to account for individual clouds or mountain ranges, which have a cooling effect.

We also don't know how much of the increased CO2 emissions that green plants will absorb through photosynthesis. We do know that it takes a tree 30 years to make carbon; it takes us just 30 minutes to pump the same amount into the atmosphere.

Schneider argued that the study of climate and global warming is no different than the kind of subjective analysis that happens in medicine, economics or other sciences.

"You don't get your heart repaired by going to a DNA specialist," because that kind of scale isn't necessary to take some kind of remedial action.

Computer models, while shaky at predicting climate at local and regional levels, do show good correlations with what has actually happened in nature at continental and global scales, Schneider added.

The models predicted an actual drop in temperature in Earth's lower atmosphere, but a rise in surface temperature. That has been observed.

But when it comes to longterm global warming, Schneider said, "There is no exact way to demonstrate it except to hang around and measure it."

## INDUSTRY RESPONDS

Alberta's petroleum industry advises caution in responding to a potentially warmer world.

Science has been unable to directly link the predicted change in temperatures to increased CO2 emissions, or determine whether this change is within natural longterm climate variability, says Doug Bruchet, former vice-president of environment, health and safety with the Canadian Association of Petroleum Producers.

Wayne Thorp, general manager of woodlands for Daishowa-Marubeni International Ltd. in Peace River, says the forestry industry agrees that, while strategies are needed to reduce the risk of climate change, there's insufficient scientific evidence to justify costly programs.

Bruchet pointed out that the petroleum industry contributed between seven to 8.5 per cent of Canada's CO2 emissions in 1990, when the country signed an international agreement to not let emissions rise above that year's level.

China and India -- both burning immense quantities of coal -- didn't sign that agreement. Without them, Bruchet said, "there'll be no hope of stabilizing greenhouse gases."

Since 1990 in Canada, oil production has increased 15 per cent and is projected to increase by 33 per cent by the year 2000. Natural gas production will rise even faster.

Despite that increased production, Bruchet said, members of the Canadian Association of Petroleum Producers have voluntarily reduced CO2 emissions by more than two million tonnes since October, 1994. Twenty-five companies have produced action plans to accomplish more.

But the oilpatch recoils in horror at the prospect of a carbon tax -- a levy on fossil fuel production and use -- advocated by climate experts like Schneider.

"In my world there's no carbon tax," Bruchet said bluntly.

Earlier this week, however, a report by the Organization for Economic Co-operation and Development said Canada's greenhouse gas emissions are among the highest in the OECD on a per-capita basis. The country, it said, will not meet its commitment to stabilize emissions if it relies solely on voluntary measures.

## WEIGHING THE RISKS

Global warming is related to many environmental issues, from pollution of waterways to disappearance of wilderness and non-human species, says Rob Macintosh, policy director of the Pembina Institute for Appropriate Development, a citizens' environmental research and education group based in Drayton Valley.

Our planet is finite. Earth has a limited "carrying capacity" to absorb waste and adapt to changes wrought by an exponentially-increasing human population.

"We are recognizing that we are up against the limits," said Macintosh.

Science, he noted, has consistently under-predicted the impacts of environmental change because ecosystems are so complex and interconnected.

Two examples: the pesticide DDT had a devastating effect on bird reproduction, almost wiping out the peregrine falcon; and chlorofluorocarbons, industrial organic chemicals, have damaged Earth's protective ozone layer.

When it comes to greenhouse emissions, "aiming for stabilization (at 1990 levels) is not adequate," Macintosh said.

"It boils down to weighing risks of action versus risks of inaction."

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Even over a century, most ecosystems will have serious difficulty adapting to predicted shifts in rainfall and temperature patterns, and to more severe droughts, floods and storms.

Yet for the average citizen, those longer-term changes in climate are not as "real" as today's weather -- whether that involves tanning beside the beach or sliding along snowy streets.

Cautions Macintosh: "If you accumulate enough weather over years, you have climate."

Scientists say it is impossible to directly link global warming to one season's near record-breaking hurricanes, this winter's first snowstorm or next summer's drought.

But the longterm warming trend may be loading the dice slightly in favor of extreme weather events, "and it's just barely detectable now," said climate expert Schneider.

The science behind global warming has been sufficiently convincing to put the issue on the public's agenda, says John Donner, executive director of environmental affairs for Alberta Energy.

But in responding, governments are wary about intervening in the marketplace -- especially in Alberta which suffered economically under the federal Liberals' National Energy Policy.

Policy makers want a "no-regrets" approach, based on a credible assessment of the longterm impact, said Donner, a representative on the Clean Air Strategic Alliance, which includes environmental groups, industry and government. "That seems to be where we are in Canada."

The UN's International Panel on Climate Change, which meets again in December, recommends several strategies in its latest report, including:

* Switching from coal and oil to natural gas.

* Turning to nuclear and solar energy.

* Slowing deforestation.

* Altering land-use and traffic patterns

* Curbing automobile use.

* Changing lifestyles and employment patterns.

Most experts agree it will be difficult, if not impossible, to get international co-operation on any of those strategies.

Like that of a sick patient, Earth's temperature appears destined to rise.

MODERATING GLOBAL WARMING

The tricky business of measuring global warming is becoming more precise. Forces such as greenhouse gases warm the Earth. Other factors, such as clouds and soot, cool it. Factories and power plants create much of the carbon dioxide - the prime greenhouse gases - but forests, plains and plankton absorb it.

1. Industries and cars create greenhouse gases - carbon dioxide and nitrogen oxide - which rise into the atmosphere.

2. The greenhouse gases increase the amount of heat trapped in the atmosphere. The gases prermit the sun's shortwave rays to enter the atmosphere, but trap the longer radiated heat waves from the Earth's surface.

3. Sulfate clouds created as a result of industrial activity act like beach umbrellas, shielding the Earth from the sun's heat and helping to create regional cooling.

4. Natural clouds can also have a reflective cooling effect and on any given day half the world is shielded by clouds.

5. Forest, tundra and ocean plankton absorb large guantities of carbon dixide, helping to moderate the greenhouse effect. These ecosystems are called "carbon sinks."

Knight-Ridder Tribune

## Graphic

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